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No. 3—Physiological Aspects of Bovine Sterility*

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INTRODUCTION.

The frequency of bovine sterility is very high, especially in dairy herds. From surveys made in different parts of the country it has been found that from dairy herds there is a wastage of about 22 per cent. of the cows each year. Sterility accounts for about 25 per cent. of the cows which comprise this wastage (Wright) and so adds considerably to the costs of milk production. Many of these cases follow outbreaks of contagious abortion (*Brucella abortus*) and infection with *Trichomonas*, but there are a large number in which no pathological cause can be found. Most of these cases come under the heading of temporary sterility, but the farmer who must keep up a regular milk supply cannot afford to keep these cows for long periods without milk production and so they go to the butcher. It is proposed to discuss such cases in their relation to the normal physiological processes of reproduction.

THE BULL

It was formerly considered that a bull was either fully fertile or sterile, but it is now known that all degrees of fertility exist. Slight abnormalities in the cow may be of no consequence when a bull of high fertility is used, but may result in sterility when the bull is of low fertility. Although it requires only one sperm to fertilise the ovum, the chances of any one sperm getting to the top of the Fallopian tube at the right time (just after ovulation) to fertilise the ovum are very small indeed and many hundred thousands of sperms have to be present in the ejaculate before there can be any degree of certainty that the ovum will be fertilised.

The best method of testing a bull is by use of the artificial vagina (Walton): the semen is then collected in a pure state and can be measured. It is not necessary to have a cow in oestrus; only a breeding crate to hold the cow still is required (Edwards and Walton). A normal bull ejaculates on the average about 5 c.c. of semen in which there are about 4,800 millions of spermatozoa. A bull of low fertility may, if he has had a rest, produce quite a good sample at the first jump, but with successive services at short intervals the sperm content quickly declines. When testing a bull for fertility this "exhaustion test" is the best one to use (Walton and Edwards). In practice a bull of low fertility often manages to impregnate his cows all right until he is called on to serve a large number of cows in a short space of time, and then his defects become apparent.

In addition to measuring the volume and estimating the number of sperms present, by making counts with a haemacytometer, there are other ways of assessing the potential fertility of a semen sample. The opacity of the sample is a rough guide, if microscopically it has been determined that this is due to active sperms and not to leucocytes, for the more sperms there are present the more milky the semen appears (Burbank). In addition some measure is required of the vigour of the sperms; this can be done by measuring the oxygen consumption with a Barcroft apparatus (Walton). A simpler method suitable for field work which has been used by Webster for rams consists of taking an accurate *p*H determination of the semen; active sperm produce much CO_2 and so if there are many active sperms in the semen the reaction is acid, whereas if the sperms are few or inactive and the alkaline secretions of the accessory glands predominate, the semen is alkaline (7·0 or over) and of low fertility.

No completely satisfactory methods for raising the sperm content of the semen have yet been found. It is known that rations deficient in vitamin E cause lack of sperm production (Evans and Bishop) but normally where the bull is receiving greenstuff and bran there is not much likelihood of this vitamin being deficient in the ration: in cases where it is likely wheat germ oil or sprouted oats may be fed. It is said (Smirnov-Ougryumov) that the feeding of rations

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high in proteins of animal origin, such as milk, meat and fish meal, has a beneficial effect on sperm production. Low fertility often occurs in young pedigree bulls which, after being reared on a high plane of nutrition by milk feeding, are sold to go into a commercial herd where they are frequently over-used and underfed. Old bulls, on the contrary, appear to suffer most from over-feeding combined with lack of exercise and under-use, which makes them fat and not only slow at service but also of low fertility. Exercise itself is said to increase fertility in bulls (Miller and Graves). The activity of the testes depends on the secretion from the anterior pituitary gland, but, although increase of the internal secretions of the testes and so the amount of secretion from the accessory sex glands and desire for mating can be increased by injections of pregnant mare serum and pregnant women's urine hormones (prolan B), the effects of these on sperm production are negligible. It is possible, however, that the injection of the follicle-stimulating hormone of the anterior pituitary (prolan A—see below) may be found to be of use. Berliner and Warbritton found that they could increase the sperm production of rams in the non-breeding season by injections of this in conjunction with thyroxin which speeds up metabolism and reduces fat.

Semen can be obtained from a bull which is impotent because of sore feet, injury or adhesions to the sheath, etc., by massage of the vas deferens through the rectal wall (Miller and Evans); if the vesiculae seminales are massaged first and their fluids collected separately this forms a good method of collecting sperms for storage and artificial insemination.

The Preliminaries to Fertilisation.

Normally the semen is deposited in the upper end of the vagina and the spermatozoa obtain entrance to the uterus by swimming through the cervix, which during oestrus secretes a thin watery mucin. Circumstances may arise, such as inflammation in the external *os*, or incomplete relaxation and opening of the cervix during oestrus (see below), or incomplete liquefaction of the mucin, which prevent or reduce the number of sperms which obtain entrance to the uterus and so diminish the chances of fertility. The douching with warm bicarbonate of soda solution before service, which has frequently been advocated as a cure, possibly produces its effect firstly by the warmth increasing the natural symptoms of oestrus such as the relaxation of the cervix. (According to Zwaenpoel and Royer warm water in the vagina will cause mares to exhibit symptoms of oestrus.) Secondly, it increases the fluidity of the mucus by being a dilute alkali; its effect is probably due to this rather than any direct action on the life of the sperm. A good sample of semen is usually far more acid than any acidity found in the female tract.

Other, and probably more certain, means of overcoming the difficulties the sperms may meet in the ascent of the cervix consist of (1) an intensification of the symptoms of oestrus by squeezing out the corpus luteum (see below), and (2) artificial insemination.

Normally only a small fraction of the sperms in the ejaculate ever reach the uterus and the vast majority of them remain in the vagina. This is accentuated in such circumstances as have been mentioned above. By inseminating directly into the cervix in such cases, therefore, the chances of fertility are considerably increased. Thus Sørensen, who inseminated a large number of cows in Denmark, found that by artificial insemination he obtained a rather higher percentage of fertility than by normal matings, while Siebenga in Holland has successfully treated a number of sterile cows by this method.

If, as frequently happens, the cow fails to cleanse completely after calving and a certain amount of inflammation exists in the uterus a larger number of sperms than normal will be required to effect fertilisation. Spermatozoa are attracted to leucocytes and become agglutinated by them, so that where large numbers of leucocytes are present in the uterus at the time of service the chances of fertilisation are reduced. This is again a quantitative action and the more sperms that obtain access to the uterus the higher will be the chances of fertilisation.

THE COW

Recent physiological research has shown that the mechanism of the oestrus cycle consists in a delicately adjusted balance between the internal secretions of the anterior pituitary gland and the two ovarian secretions—oestrin and progesterone—produced from the follicle and corpus luteum respectively. There are two anterior pituitary hormones which act on the ovaries: one—the follicle-stimulating fraction (prolan A)—causes the follicles to increase in size and ripen, and the other—the luteinizing hormone (prolan B)—causes ovulation and the formation of luteal tissue from the granulosa of the follicle.

Under the influence of prolan A the follicles ripen and the ovary produces large quantities of oestrin which in turn gives rise to the symptoms of heat—the vulva becomes slightly swollen, the cervix becomes relaxed and dilated and the mucosa of the uterus, and especially of the cervix, secretes a thin watery mucin which lubricates the whole tract and makes ascent of the sperm easy. Incidentally, this is the only time in the cycle when the secretions from the uterus are discharged from the cervix and so is the time when uterine infections can be detected from cervical smears.

Ovulation normally occurs just after the end of heat, and about 72 hours after the end of heat the flow of mucin becomes opaque by the inclusion of leucocytes and frequently red blood corpuscles in the case of heifers or cows in good condition. These are a natural occurrence as a result of the congestion of the tract at oestrus and their appearance at this time should not be confused with the pus that occurs as a result of infections at other times in the cycle.

Ovarian Cysts

If, for some reasons not yet known, the luteinising hormone (prolan B) is not secreted from the anterior pituitary gland when the follicle is ripe, ovulation does not occur and then either (*a*) the ripe follicle may go on enlarging and form a large cyst or (*b*) other follicles may ripen and form a number of small cysts in the ovary. In the first case the cow usually fails to exhibit any further psychological symptoms of heat, although the physical symptoms such as swollen vulva, relaxed and open cervix and a raised tail-head (like a cow about to calve)—all symptoms of the action of oestrin—are intensified. A somewhat similar separation of the physical from the psychological symptoms of heat occurs in the so-called still-heats of cows where ovulation occurs without the cow showing a desire for mating (Weber): these are more liable to occur during the winter months. In the second case of small multiple cysts the physical symptoms are similar but the psychological symptoms of heat appear every few days as each follicle ripens.

Large ovarian cysts can be ruptured by pressure through the vaginal wall. One hand in the rectum is used to bring the ovary down to the top of the vagina from which, because of the thicker vaginal walls, more pressure can be safely put on by the other hand—or, if necessary, pressure from both can be exerted. In cases where the cyst is of long standing and the walls are very tough, or the cyst is small and situated centrally in the ovary it can be punctured by needle through the vaginal wall by the same technique.

In many cases cysts re-form in the ovaries after rupture. If, however, these newly formed cysts are ruptured some 7 to 10 days after the first rupture, then a corpus luteum is formed from the granulosa cells and a normal cycle is produced. The cow comes on heat normally about 21 days after the second rupture and if served conception will occur (Hammond; Marshall and Hammond).

Occasionally cases occur in which the ovary contains a cyst even though the cow ovulates and forms a corpus luteum. Such cows are very difficult to get in calf unless the cyst is ruptured. This is probably caused by the abnormally high oestrin secretion from the cyst for it has been found that animals can be rendered sterile by injecting oestrin after ovulation; under such conditions the fertilised ova are locked in the Fallopian tubes and do not enter the uterus (Pincus and Kirsch). If large quantities of oestrin are injected at a later stage, attachment of the developing ovum to the uterine mucosa is prevented, or if attachment has been made absorption or abortion of the embryo may be caused (Parkes and Bellerby).

The Corpus Luteum

Under the influence of the luteinising hormone of the anterior pituitary (prolan B) the corpus luteum remains active until about the 19th day of the cycle when it begins to atrophy and the new follicle begins to ripen. If the ovum is fertilised, however, an internal secretion from it stimulates the pituitary to produce more prolan B and the corpus luteum does not atrophy at the end of 19 days, but persists throughout pregnancy. For some reason, at present unknown, it occasionally happens that this occurs even though the cow is not pregnant; the corpus luteum persists as it does during pregnancy and the cow may go for many months without showing signs of heat, although she is not pregnant. By squeezing out the corpus luteum from the ovary the cow can be caused to come on heat and breed (Hess).

It is generally believed that, when a cow for any reason has been prevented from breeding for some time, she becomes more difficult to get in calf. The reason for this may be that luteal tissue accumulates in the ovaries from successive ovulations and upsets the delicate internal secretion balance of the cycle, leading to less marked physical symptoms of oestrus although the psychological symptoms appear as usual. Be this as it may, there is a very large number of sterile cows which have quite regular heat periods, and in which no abnormal anatomical or pathological condition exists; many of these cows can be cured of their sterility by removing the corpus luteum (Hammond, 1936; Rumianzev). Under the influence of progesterone (the internal secretion of the corpus luteum) the cervix becomes tightly closed and the secretions of the mucosa are dry and sticky so that conditions are unfavourable for the ascent of the sperm (see above).

The corpus luteum is best removed from the ovary between the 8th and 12th days after oestrus. At this time it is loosely attached and is most easily squeezed out; before this time it is not fully developed and is too small to get out with certainty, while after this time it begins to sink down into the tissues of the ovary and is then much more difficult to remove. Moreover, if the corpus luteum is removed fairly early in the cycle the progesterone does not have much time to act and the second heat coming shortly after the first keeps the reproductive organs

under the influence of oestrin and intensifies the physical symptoms of oestrus (see above). After squeezing out the corpus luteum heat occurs usually in from two to six days, and the cow should be mated at this heat. Occasionally, however the cow, does not hold to this service, and if so one more service is usually allowed before the treatment is repeated.

In cows the operation is best performed by inserting one hand in the vagina, using this to pull back the cervix, bring the uterus into easy reach and steady it, while the other through the wall of the rectum grasps the ovary and by steady continuous pressure from the fingers at the base of the corpus luteum loosens it from its attachment to the ovary. In most cases it is easiest to grasp the corpus luteum within the fingers so that when it is removed it remains within the fingers and the ovary slips back into its place. If this is done it can be felt whether or not the whole of the corpus luteum has been removed, for, if too hard pressure is put on in the centre of the corpus luteum instead of a steady pressure around the whole of the ovarian periphery of the corpus luteum the corpus luteum may split in two and only part may be removed. Complete removal is necessary if the internal secretions of the ovary are to be affected.

In heifers, the vagina is usually too small to admit the hand so that removal of the corpus luteum must be done by one hand from the rectum only. The uterus, however, is smaller and does not obscure the ovary, while the ovarian ligaments, not having been stretched by a previous pregnancy, hold the ovaries within easy reach and so make removal of the corpus luteum easier. The vagina is not merely stretched by the act of parturition; active growth occurs in it during the latter part of pregnancy. It seems possible that this growth is due to oestrin in the blood, for in heifers and cows with cysts in the ovaries the vagina is usually enlarged. Incidentally lack of this growth is one of the causes of difficult parturition.

Ovarian Inactivity

Occasionally in cows and much more frequently in heifers during the winter months the ovary ceases to function and no follicles are ripened. This occurs mainly where the heifers are in poor condition or where they are kept in on dry feed. In such cases follicles usually begin to ripen a few weeks after they have been turned out to grass in the spring. Massage of the ovaries has been recommended in these cases to increase their blood supply and so the amount of prolan A which reaches the ovary. A more efficient means of treatment, however, is by injection of gonadotrophic hormones.

Gonadotrophic Hormones

In addition to the above-mentioned operative means of controlling ovarian function, the injection of gonadotrophic hormones appears to offer great possibilities as soon as standard pure products are put on the market and when the best dosage and time of injection have been worked out.

There is a lot of research work yet to be done in this field, but a beginning has already been made. What I have to say under this heading should, therefore, be considered as an indication of what may be expected from work on other species (Allen) rather than in all cases of established fact obtained from experimental results on the cow, such as are given in the previous section.

Follicle-stimulating hormone (prolan A) exists in the pituitary gland of all species, but in most species it is mixed with considerable quantities of ovulating and luteinising hormone (prolan B) and so causes not only ripening but also luteinisation of the follicles. These two fractions can be separated by chemical means, however, for the purpose of injection (Fevold, Hisaw and Leonard).

The pituitary of the horse, however, contains the follicle-stimulating hormone in great excess with only small quantities of the luteinising fraction so that when injected subcutaneously in moderate doses it produces the follicle-stimulating effect only. On the other hand, pregnant women's urine hormone consists entirely of prolan B, the ovulating and luteinising hormone, so that when injected intravenously, it does not cause follicles to grow, but only ruptures and/or luteinises those that exist in the ovary. Pregnant mare serum hormone consists chiefly of follicle stimulating hormone.

By injecting pregnant women's urine hormone or pregnant mare serum hormone into cows, Zawadowsky *et al.* found that they could bring the cows on heat in about 24 hours and cause ovulation, no matter at what period of the cycle it was injected. Heat periods induced in this way, however, do not change the normal cycle rhythm of the cow, for the cow comes on heat again, not three weeks after the induced heat, but three weeks from the last natural heat period. That is, the corpus luteum in existence controls the length of the cycle; newly formed corpora lutea produced by injection do not take control of the cycle when an active corpus luteum is already present in the ovary. The heat periods induced by prolan B injection, therefore, differ from the heats induced by removal of the corpus luteum, for in the latter the rhythm of the cycle is changed over to that of the induced heat. Fertility as the result of mating during the induced heat differs also in the two cases. There is usually no difficulty about conception at induced heats caused by the removal of the corpus luteum; but there is difficulty in obtaining pregnancy by matings at

heats induced by prolan injections during the cycle because, since the corpus luteum in being at the time of injection controls the uterine changes, the uterine mucosa will usually not be in a fit condition to implant the embryo when it reaches the implantation stage. Where no corpus luteum already exists in the ovary some form of mixed prolan A and prolan B (ox or sheep anterior pituitary or pregnant mare serum) may be used to ripen and rupture the follicles. Thus it would appear that these hormones are suitable to use in the case of cows or heifers whose ovaries are in an inactive state (as is often found during the winter months) or to hasten the onset of oestrus after calving. It would appear also that prolan B injected intravenously can be used successfully in cases of multiple cysts where by causing the formation of luteal tissue it will initiate normal cycles again. It has been successfully used for this purpose by Day in mares, but not yet in cows.

Follicles may be made to ripen in ovaries which are in an inactive state by the injection of follicle-stimulating hormone—prolan A—but, so far, the proper dosage has not yet been worked out. If too large quantities are given there is the danger that not one but many follicles may ripen and so cause multiple pregnancies. For example, by injecting 30 mg. of dried horse pituitary (dissolved in NaOH and neutralised to *p*H 7 :—4 by HCl) per day for three or four days before the normal time of heat in ewes a large number of follicles are caused to ripen. If intravenous injection of prolan B is made as soon as the ewe comes on heat up to 15 eggs are shed and up to five embryos have been obtained.

After injection of prolan B ovulation occurs in about 30 to 60 hours. So that if fertilisation is to be effected heat and mating or insemination should take place before this time. Under normal conditions heat lasts on the average for about 16 hours, although it may vary from 6 to 30 hours ; ovulation occurs on the average about 27 hours after the beginning, or just after the end, of the heat (Hammond ; Gerasimova).

Anti-gonadotrophic Hormones

Recently it has been found possible to produce anti-gonadotrophic hormones (Parkes and Rowlands ; Collip). For example, by long-continued injections of prolan B into an animal the blood serum of such an animal is found to contain antibodies to prolan B—so that injection of such blood serum into another animal will prevent ovulation and the formation of corpora lutea. Quite how this knowledge is to be used in dealing with cysts is not clear until further experiments have been done. It should, however, be a warning that the wholesale repeated injection of animals with gonadotrophic hormones may aggravate rather than alleviate the trouble of sterility.

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Discussion

For the discussion of the foregoing paper by Dr. John Hammond a very large assembly regathered in the Town Hall, Great Yarmouth, for the second session of the morning of Tuesday, July 25th.

In the absence of the Chairman (Professor J. B. Buxton), the session was presided over by the Vice-Chairman, Mr. J. R. BARKER, who extended a cordial welcome to Dr. Hammond and called upon the first of the openers of the discussion, Dr. Nicholson.

Professor J. A. NICHOLSON, PH.D., M.A., M.R.C.V.S. (Veterinary College of Ireland): I am sure you will all agree that Dr. Hammond has given us a most interesting and instructive paper. We are most fortunate indeed in having such a recognised authority as Dr. Hammond with us here to-day to give us his views on the subject of sterility in cattle and I feel it a great privilege to open this discussion not only because of the interest and practical importance of the subject itself but also for a personal reason, since it was Dr. Hammond who first aroused my interest in animal physiology in general and sexual physiology in particular.

I am very glad indeed that he referred to the question of sterility in bulls and I only wish that he had enlarged upon this aspect of the question because I think it is of the greatest importance. Although accurate statistics are not available there is evidence from reports received from farmers and others that sterility in bulls is increasing. This increase, however, may not be real but only more apparent since the introduction of schemes for licensing bulls and for the elimination of scrub bulls which, however desirable in other respects, essentially have the effect of limiting the number of bulls available for breeding purposes. Thus reliance is placed on one bull for the fertilisation of 40 or perhaps 50 cows; should he be infertile or of reduced fertility, the results are disastrous.

It is well known that the fertility of bulls varies enormously and that it is impossible to assess this simply by inspection or routine clinical examination. There are, however, certain facts worth bearing in mind in this connection. In the first place sterility in male animals is seldom permanent unless of course there is some specific disease or defect of the reproductive organs. Further, the reproductive processes will not function at their best either in the male or female unless the animal is in good health. The overfed, fat, lethargic bull which is too often to be seen can hardly be considered to be in full health and it is not surprising that as a rule his fertility rate is extremely low. It cannot be over-emphasised that the proper feeding and management of breeding animals is all important.

Further than this, there is what Heape has called a sexual season in the male as well as the female. This is clearly seen in many wild animals and rams and although under domestication the bull is capable of carrying out sexual intercourse at any time, there is no doubt that spermatogenesis does not go on at the same rate throughout the year. In fact, histological examination of testes from fully fertile animals shows that in some tubules spermatogenesis is actively progressing whereas maybe in a neighbouring tubule there is degeneration of the epithelium and spermatogenesis has ceased. It is evident, then, that degeneration of the tubules is easily invoked and in the wild state it may be regarded as a normal process. But given the right conditions it can be easily and fully repaired. Now, as Professor Lagerlöf has clearly shown, it is the number of fully formed, actively motile spermatozoa in a sample of semen which is of importance, so that conditions under which spermatogenesis can go on actively must be maintained if the animal is to be fully fertile. This, no doubt, is largely a question of the food supply (particularly vitamin E), external temperature and the general health of the animal, but it is now certain that the production of semen containing fully developed spermatozoa is also greatly influenced by hormones.

The endocrine functions of the testis are carried out by the interstitial tissue whereas the seminiferous epithelium is solely concerned with spermatogenesis and the two tissues react differently to different stimuli, *e.g.*, temperature. Nevertheless the two functions of the testis are interdependent. Testosterone, the hormone produced by the testis, the break-down product of which, androsterone, appears in the urine, has been shown to favour spermatogenesis although its main function is to induce the appearance of the secondary sexual characters, influence the anterior lobe of the pituitary and also the secretory activity of the accessory sex glands, particularly the prostate and seminal vesicles. In addition, the testis is now considered to produce an oestrogenic hormone which is also necessary for the proper development of the accessory sex organs and it has been suggested that a third hormone acting mainly on the anterior lobe of the pituitary is also produced by the testis. In turn, the testis is influenced in much the same way as the ovary by hormones from other sources, particularly the anterior lobe of the pituitary and the thyroid, so that the correct production and interaction of hormones

are just as important in the male as in the female.

It is to be hoped that an improvement in the fertility rate of bulls will follow the wider application of such procedures as Walton's "exhaustion test"—examination of spermatozoa—which is a most useful guide since bulls with semen containing many abnormal spermatozoa always possess a low fertility rate, and the study of fertility records.

I agree with Dr. Hammond that the *p*H of the vaginal secretion is not of such importance for the viability of spermatozoa as was once thought; it must, however, receive some consideration and cannot be dismissed as wholly unimportant. Semen is a well-buffered fluid and can maintain its *p*H when exposed to a considerable degree of acidity, provided that the volume of semen is adequate. A small volume of semen has not the same buffering capacity as a larger volume so that in cases where there is a small semen volume, perhaps together with an increase of vaginal acidity, a deleterious effect on the spermatozoa is likely to be produced. Doubtless vaginal douches have a beneficial effect in ridding the os uteri of accumulated mucus and thereby permitting the spermatozoa freer entry into the cervical canal. This, as Quinlan has shown, is of the greatest importance, for the cervical canal may be regarded as a reservoir from which spermatozoa pass up in streams to meet the ovum in the Fallopian tube. The importance of free entry into the cervical canal is further emphasised by the observation that the birth rate in cows in which the spermatozoa had been placed directly into the canal during artificial insemination was higher than in a comparable group of cows which had been served normally. Apart from any such questions, as neither spermatozoa nor ova live long in the female genital tract, it is of the greatest importance that service should be performed at or about the time of ovulation.

It would indeed be of great value if there were reliable means of determining whether or not ovulation had taken place and with increasing knowledge of the changes which occur in the female genital tract and improved methods for the detection of the various hormones in the urine and blood stream, perhaps it will become possible to do so, but it cannot be done as yet. Moreover, the precise mechanism of ovulation is not known. It is easy to postulate that the anterior lobe of the pituitary produces two fractions, prolan A and B, but up to the present all attempts to separate them have failed. The reason for this failure is, I think, not far to seek. It is the tissue which determines the reaction and not the hormone—which, as I had occasion to point out recently, acts merely as a stimulus. Tissue reactivity is affected by many factors, particularly age and the general health of the animal, so that even with two animals of the same species, sex and age, there may be a different response to the same stimulus and a different response is all the more to be expected in different species of animals. Experiments with gonadotrophic hormones clearly show this; different results in different animals are the rule and not the exception. In this case the position is complicated by the fact that there are several sources of gonadotrophic hormone and the preparations made from them have not exactly the same actions. The chief of these at present available, as Dr. Hammond has said, are extracts made from the anterior pituitary lobe of animals, extracts from the urine of pregnant women and extracts from pregnant mare serum. Pregnant mare serum is claimed to be most active in inducing the development of follicles in women but this is not to say that it will have the same effect in animals. Indeed, it is difficult to understand why follicle-stimulating hormone is required by a pregnant mare at a time when no follicles are developing and the sexual cycle is in abeyance. In my experience with small laboratory animals the luteinising effect of pregnant mare serum is its chief characteristic. In addition to all this it now appears that there is another factor produced by the anterior pituitary lobe which conditions the action of gonadotrophic hormones on the ovary and testis. This factor has been called "synergist" and in some animals its presence will intensify the reaction produced on the injection of human pregnancy urine. It seems then that the prospects of success with gonadotrophic therapy are, to say the least, limited and the results are likely to be conflicting until purer preparations become available.

I feel that the value of such preparations will lie not so much in their ability to restore diseased reproductive organs to health but in providing a means of maintaining normal reproductive organs in fulll working order.

Professor W. C. Miller (Royal Veterinary College, London): I find it somewhat difficult to know how to deal with the duty of contributing to this discussion, which the Local Committee have laid upon me.

In the first place, there are some general observations which although they may have been made by others in the past are, I believe, well worth making again. The general problem of bovine sterility of physiological origin is, in its present-day aspects at least, a comparatively modern one. There must be many of the elder practitioners present who can remember the early years of the century when a barren cow on an ordinary commercial farm was not a common occurrence. One or two cows a year which failed to breed among a herd of 25 or 30 was perhaps the highest proportion which could be expected. Very many herds would go for

two or three years without having more than a single sterile cow. Just before the War, such records as exist would seem to suggest that sterility was increasing, but it was not until in post-War years that dairy farmers began to become conscious of an increasing rise in the percentage of sterility, and during more recent years this has increased.

The next point worthy of note is that now the incidence is not uniformly spread over all cows —beef, dual purpose, and milk-producing—nor is it uniform under varying types of management. It would be difficult to say where the least loss occurred, but I think it is generally agreed that the incidence of sterility is all round definitely highest in dairy herds kept under the more intensive systems of management. It is common knowledge that among the cows which have competed and perhaps won high-yield contests at shows, etc., a large proportion become incapable of breeding subsequently; whereas in the reasonably well-managed commercial dairy herd where cows are not forced for high production, and where a less intensive and more natural and rational system of management is carried out, the number of cows which do not breed, or which breed irregularly, is even still comparatively small.

This consensus of opinion leads one to postulate that the physiological disturbances which are suffered by the reproductive organs under intensive systems of management do not occur, or occur to a less extent, under more normal systems. From this point it becomes of some importance to consider what individual factors there are in modern intensive cattle management which may play major or minor parts in the aetiology of sterility with a physiological origin.

I think that these factors fall into the following categories:—

(1) Feeding;
(2) Lack of sufficient exercise;
(3) Intensive mammary activity,

and I would like to say a word or two about each.

Feeding.—There is a modern tendency, which is increasing rapidly, for the farmer with a herd of heavy milking cows to save himself the trouble of making up a balanced ration, or of having to mix the ingredients of a concentrated mixture, by purchasing one or other of the numerous compound dairy cakes now on the market. On the other hand, the breeder whose stock is not under such intense conditions tends to use a bigger amount of home-grown foodstuffs. It is admitted that so far as modern knowledge of nutrition is concerned, compounded foodstuffs are probably better balanced in respect of protein and starch than are the rations of the man who uses more home-grown foods and does not bother to feed too carefully to a set of rigid standards. The point, however, has been lost sight of that when a whole seed or grain, whether it be wheat, maize, soya-bean, cotton seed or a palm kernel, is intact, it is *living tissue*; while when it is ground into a meal, or when it is crushed, cooked and pressed, it is *killed* and becomes like any other dead tissue liable to undergo one or another type of disintegration or degeneration.

The breeder who feeds whole foods, or crushes or bruises his oats, grinds his bean or pea meal, etc., and uses these up after only a comparatively short period of storage, is feeding substances which have a very different nutritive value in the animal body, than the same or other foods prepared months or even weeks earlier. The fringe of knowledge of plant hormone substances, auxines, enzymes, vitamins and provitamines, and so on, has been touched but only touched. There is a wide field still to be investigated. It is already known that certain plant sterols, for example, are utilised by the body without change. It is possible to associate the excessive use of prepared foods deficient in plant hormones, etc., with a deficiency of hormone production in animals subsisting on them, but we do not yet know the details. This may well be a factor of fundamental importance. A well-known adjuvant to the clinical treatment of physiological sterility is to turn the cows out to grass, where they obtain a supply of living plant foods. I must add the qualification—provided they can be turned out before they develop into chronic cases.

Inadequacy of Exercise.—It will not be necessary to do more than remind an audience, such as this, of the physiological importance of adequate exercise upon the blood and lymph circulatory systems, upon respiration, digestion, skeletal muscle tonus, and so on, and consequently upon the whole of the organism. The system under which a very large number of dairy cows are kept, especially during winter time, is strikingly abnormal from a purely physiological point of view, and many of the better class herds could be much improved in health by more rational exercise. In this respect the system of management of many young bulls of the beef breeds and to a less extent of the dairy breeds, is nothing less than reprehensible. The health of the dairy cow and her reproductive capacities are being sacrificed on the altar of high milk yield.

Heavy Lactation.—By breeding and selection, a race of dairy cows has been evolved which suffer from anatomical and functional mammary hypertrophy. The secretory cells of the mammary acini require a hormone stimulus before they can function and this we now know is provided by the anterior pituitary in the form of *prolactin*—the principal galactogogic hormone. Unfortunately, the anterior pituitary cannot become equally as hypertrophied as the udder, because of its anatomical situation. Its tissues

are concerned with the elaboration of at least six other hormones, each of which is of primary importance, and in the absence of any possibility of becoming hypertrophied, it is logical to postulate that when a demand for excessive prolactin production occurs from a highly developed udder, the production of other hormones may be embarrassed. Among these others are the anterior pituitary follicle-stimulating hormone (the APFS for short), the anterior pituitary luteinising hormone (APL), the growth hormone, needed for general cellular proliferation of both adult and foetal tissues, thyrotrophic hormone, and so on. Dr. Hammond has outlined the bearing that the use of the first two of these may possibly have in the treatment of cases of bovine sterility. Present indications are that in many cases of the type of sterility we are discussing, the body system is unable to provide its own supplies in adequate amounts. It well may be that the radical cause is inability of an already overworked pituitary to provide enough gonadotrophic hormones to maintain normal ovarian function. Whether or not it is advisable to stimulate a sluggish ovary by artificially increasing the amounts of these hormones in the circulation by injecting them, must, I think, remain an open question in the meantime. It has been my experience with comparatively limited numbers, that the results in what seemed to be appropriate cases were disappointing. The cow which remains in subnormal but persistent oestrus, and in which one (or more) small stationary follicle can be palpated, might be expected to respond to a preparation of follicle-stimulating hormone (*e.g.*, a pregnant mare serum product), but does not always do so.

Similarly, the cow which has a large follicle in one ovary and which will accept service daily for four or more days, might be regarded as a suitable case for the use of luteinising hormone (from human pregnancy urine). Some do respond satisfactorily, without doubt, but there are others which fail to respond. As Dr. Hammond points out, dosage may be at fault, and more work is required to determine the necessary amounts needed.

It may not be inappropriate to suggest that practitioners should make a point of avoiding the use of hormone preparations in cases of any and every type of sterility. A diagnosis of the physiological cause is the first essential and the appropriate hormone treatment must be chosen in relation to what is found. It is obviously unfair to blame a preparation for not producing successful issues if it has been the wrong material. A further point of importance is that it is not always possible to diagnose a case at a first visit. A second or even a third examination to cover as much of an oestrus cycle as possible is useful, and there is no doubt that examination just before, during, or just after oestrus will give most information.

I think that we are not yet at the stage when we can always usefully recommend hormone treatment. Apart from the question of high cost, which with most of the more active hormone preparations is still almost prohibitive, we need far more knowledge of the interplay of the normal hormones in the circulation with what we propose to inject, of the inter-relationships of hormones and vitamins, and the impact of these upon mineral intakes and mineral balances, to say nothing of the complex subject of cellular and tissue enzymes. In considering bovine sterility of physiological origin, whether in male or female, I am convinced that it is essential to consider the whole subject from the widest possible approach, taking into appreciation the whole environment of the cow first, carefully weighing her past history and her present behaviour, before deciding upon any specific line of intimate treatment—whether hormonic or otherwise. It has been said, and with much justice, that in the meantime after any abnormality has been corrected, *time* is the most important single factor in bovine sterility. Unfortunately, the modern farmer is an impatient person, who wishes to speed up Nature's normal tempo.

In conclusion, may I say how much we are indebted to Dr. Hammond for having compressed into his paper such a quantity of useful and important information, and for his kindness in having prepared it for the Congress. I feel sure it will evoke a useful discussion.

Major W. H. Wortley, M.R.C.V.S. (Bungay, Suffolk): In expressing my thanks to Dr. Hammond for his interesting paper, I must first congratulate him on the wealth of his references and upon the energy which he has displayed in searching current literature.

My criticism, if anything, must be constructive and in no way destructive, for everything that the essayist has told us appears to have been vouched for by the authorities whom Dr. Hammond has acknowledged in his final references.

What the essayist failed to emphasise is that the cow to-day can no longer be regarded as a normal ruminant. In fact, the modern dairy cow is a freak; man in his greed has, by a process of selection, caused the cow to become a heavy milk-producing machine. The quantities secreted are far in excess of what is required to rear one or two calves, and thus the cow must be considered in much the same way that the average owner does his motor car. In place of petrol fed to his internal combustion engines calculating a definite mileage to the gallon, the modern farmer feeds his cow so many given calories, estimated to produce a definite gallonage of milk, allowing a minimum expenditure for her bodily needs.

Exercise, sunlight, fresh air, green foods and a long annual rest from lactation are no longer considered the requisites of the species.

In their place, he substitutes a minimum ration of cooked cereals deprived of their natural vitamins and from which, in many cases, the manufacturer has already extracted his maximum allowance of natural oils. In addition, he permits the substitution of a quota of mineral mixture which would petrify the digestion of an alligator.

No one appreciates more than the essayist the intimate relationship which exists between excessive and abnormal milk production with its demands upon the pituitary gland and the oestral cycle which is directed, in the main, by the secretions poured forth from this self-same overworked factory for the wholesale production of assorted hormones.

Smith, in his "Veterinary Physiology," says: "The number of annual sexual cycles which any given species passes through is vastly influenced by domestication. Probably in all primitive species one sexual season yearly was the rule. Domestication alters this. The abundant food supply renders the struggle for existence no longer acute, the dread of being preyed upon by the enemies peculiar to each species is removed, and one of the responses to these altered conditions is a greater desire to multiply, for the reason that the energies previously expended in the struggle for life are turned into a fresh channel."

One can no more, in the long run, cheat Nature than one can produce "Baby Austins" from an overworked taxi-cab of the same make —(laughter)—and it is not to be wondered at that the bovine milk-producing machine should revenge itself upon the unnatural demands made upon it, by refusing in a similar way to reproduce its kind.

General Discussion

Mr. H. W. Steele-Bodger (Tamworth) said that he had only a few observations to make on that subject. The first was to endorse the opinion expressed that the incidence of temporary infertility was increasing and he would like to ask Dr. Hammond if he had any information as to the relative incidence of temporary infertility in the various breeds. He asked that because, in his experience, the Guernsey breed showed a higher incidence of temporary infertility than did any other breed. He thought this must be physiological, certainly if his examinations were correct, because in numerous instances in Guernseys he found it impossible to discover any pathological reason for the cows not being in calf. Nevertheless, he would like to endorse what Dr. Hammond had said about the importance of rectal examination in these animals and he was quite certain that a very large number of animals were sent to the slaughterhouse every year as barren which were in fact in calf but which were thought to be barren because sometimes they showed regular oestral periods. He thought that was also true as it concerned the Guernsey bull: he had a remarkably large number of Guernsey bulls which had proved infertile, and incidentally quite a few young Guernsey bulls which at 18 months of age had been entirely blind as well as proving infertile.

He was interested in what Major Wortley said concerning Smith's observations. He remembered one cow that took the bull very regularly; he examined her and found that she was in calf; that cow had been served every three weeks during her gestation period, but calved to the date of her first service.

He did not think that hormones could interest them as practitioners until the cost of gonadotrophic hormones became such as to render their administration a commercial proposition.

In regard to the clinical condition of the vagina during the di-oestrous period, he should like to know how one could form a definite conclusion on that. He thought it would be of interest if one could ascertain the cause of heifers straining after service. He had failed to find any reason for this, or why they could not hold, and on three occasions now he had overcome that by light epidural anaesthesia sufficient to stop the straining, and in each case the heifer concerned had held to the first service. He mentioned that because there seemed to be no reason why they should strain and expel the seminal fluid as some of them undoubtedly did.

Mr. T. G. Heatley (Woodbridge) said that they all thanked Dr. Hammond for his paper, but for himself as a general practitioner and getting older, it was rather too academic for him to understand properly. He appreciated the work of the scientists, however, and was only too ready to apply their findings to field conditions, and in his own case the work of Russell, Greig and Dryerre on milk fever, and the patient work of Laidlaw and Dunkin on distemper had revolutionised and simplified his mode of practice, as carried out formerly. Such valuable work on "scrapie," "braxy," "lamb dysentery," and "pine," he had not been called on to apply in his own practice.

He was more concerned with the prevention of sterility than with curing it, and he tried to educate his clients as to the importance of the animals having healthy generative organs before they were bred. In his own practice, perhaps more particularly in pedigree herds where expense was more easily met, all animals were examined at 12 to 14 days after calving and an endeavour was made to correct any abnormal conditions before they became chronic.

The statistics regarding wastage in dairy herds showed a high percentage, but in his own practice this was nothing like so high.

One point Dr. Hammond had mentioned was clearing away mucus before service, but in a normal os and cervix the amount of mucus was negligible. A healthy os was about the size of the tips of two or three fingers placed together, but it might be so swollen as to be four or five inches across and the cervix as thick as one's forearm. These cases always showed an excessive amount of mucus and if this was washed away before service, the cause of the extra mucus was still present in the os and cervix, and this was one of the commonest causes of sterility.

It was no uncommon thing to find a cow breaking service at about nine weeks and if one could rule out contagious abortion it seemed to him that the uterine seal, which extended from the outer os through the cervix to the inner os, might not be normal owing to chronic cervicitis and when the uterus became active from pregnancy this seal gave way or the spermatozoon

passing through the cervix might be so affected when it fertilised the ovum that the unit so formed was not healthy and died and the cow showed oestrum. Of course that was only a theory but the results in practice seemed to support it.

He often wondered if sufficient care was taken in trying to get the uterus in a healthy condition after retention of the afterbirth. He advised withholding any attempt to breed the animal for at least three months after retention.

No doubt a great deal had to be learnt as to the function of the various endocrine glands, and that must be left to the laboratory workers, whose work he much appreciated.

Mr. W. F. Aston (Shrewsbury), speaking in reference to abnormalities of the oestrous cycle in the bovine, said that quite 50 per cent. of cows went over three months without an oestrous period if they are suckling calves. The next point on the same subject was the impairment of the breeding function in fat cattle. Heifers which had been exhibited often proved very difficult to get in calf even when reduced to healthy normal store conditions. Was there any connection between the fat deposits in early life and their failure to come into oestrus despite the fact that they had been well exercised and given the foods which nature demands they should have? He was doubtful of the sterility records offered by the essayist. There were few herds where reliable data were kept. He had only three such in his charge and their fertility was excellent: (1) 120 Hereford cows with 98 per cent. over two years, (2) 84 Ayrshire cows with 96 per cent. and 90 on another farm with 94 per cent.

Mr. J. B. Brooksby (Institute of Animal Genetics, Edinburgh), observed that he must beg Mr. Heatley's pardon, and the pardon of the group that he represented, for harking back to the physiological aspect of the subject, but it was so rarely that he had the opportunity of hearing Dr. Hammond's ideas like this, that he felt sure that they would excuse his enthusiasm.

Professor Miller and Major Wortley had referred to the abnormality of the dairy cow under modern conditions, and he did not wish to enlarge on that theme, more than to bring one aspect of it, a specific set of circumstances, to their notice. It was well known that there was a high level of oestrogen excretion during pregnancy. This level was higher in dairy than in beef cattle, and indeed, from the preliminary results of work he had in progress at present, higher in the higher yielders in a dairy herd than in the cows of low productivity. If such a correlation between oestrin production and milk production existed, the depression of pituitary activity by oestrin secreted during pregnancy would be most serious in the better dairy cows, and also in general in improved herds; and it seemed possible that the pituitary depression in such cases might persist and lead to a post-parturient an-ovular period, which was quite a common cause of sterility in dairy herds. He would like to hear if Dr. Hammond considered this oestrin-pituitary depression hypothesis a reasonable explanation of the clinical picture.

There was one other thing he would like to discuss. Dr. Hammond at one point in his paper had referred to ovarian cysts being due to deficiency of the luteinising hormone of the pituitary. Professor Nicholson had referred slightly to the non-specificity of the pituitary substances and the variation in effect from species to species. This was in line with a certain amount of work now being done which suggested that we were being rather too liberal in our separation and identification of pituitary hormones. The initial work on separation of them had not been confirmed extensively enough to make it absolutely proven, and certain workers had begun to doubt the differentiation of F.S.H. and L.H. [follicle-stimulating and luteininising hormones].

When this doubt about the characteristics of the pituitary fractions was borne in mind, the speaker felt that he was perhaps rather rash in discussing the formation of ovarian cysts in the light of the classical description. It was, nevertheless, interesting to note that Fevold and Hisaw had described cyst formation in the ovary of rabbits resulting from treatment by F.S.H. followed by large doses of L.H., that is, by methods opposite to the those postulated by Dr. Hammond for the pathological condition.

In conclusion, the speaker said he realised that his remarks were not in the nature of constructive criticism, but he felt that, when the pituitary-gonad relationships were imperfectly understood, as evidenced by the work quoted, they were almost justified in accepting Professor Miller's scepticism of the directly hormonal treatment of sterility. Much further work was necessary on the normal endocrine balance of the cow, a field of research which seemed to offer great possibilities. He again thanked Dr. Hammond for his paper.

The Chairman (Mr. Barker, Hereford), said that he found it difficult to switch over so quickly and so rapidly from the pathological to the physiological. In those herds of which he had control for the purpose of eliminating disease, he found that the physiological abnormalities described in the paper as occurring with reproduction disappeared or were lessened to an almost irreducible minimum. So the position appeared to be that when once you went beyond the normal physiological action in reproduction there was some pathological lesion.

The essayist had referred to the anterior pituitary, which must be an extraordinary sort of gland to be able to do all the things which had been claimed for it, but even the anterior pituitary could not make bricks without straw, *e.g.*, they found that in Johne's disease anoestrus occurred a long while before the ordinary symptoms of the disease were manifested, so that it is reasonable to assume that in that disease there is some control of the hypo- or hyper-functioning of the pituitary gland.

He had had some experience of the use of hormone therapy in producing clinical results. He had used antuitrin S. 500 rat units per c.c. intravenously, in doses of 2 c.c. and induced oestrus in those cows mentioned by Mr. Aston where the anoestrus period after calving was unduly prolonged, and in his experience it never failed to produce oestrus within 9 to 14 days.

In the last case, however, he found that at the 14th day she had not been in oestrus, and he injected a second dose of 2 c.c. (500 units per c.c.), and on the following morning she was in oestrus and was bulled. Therefore, in spite of information and warnings about antuitrin S., that was the actual experience he had had with the use of this product.

He had wondered, and this referred to the film they had seen on the previous day, where it was impossible to expel the corpus luteum in cases where one had a mummy in the uterus, if 2 c.c. antuitrin S. would bring about expulsion of the mummified foetus. If that were so, however, it would be rather surprising in view of

the fact that antuitrin S. should have a luteinising effect rather than an aborting effect. It was not so surprising, however, when one considered that oestrus followed close upon the natural expulsion of the mummified foetus. It was in line with nature to conclude that if one could induce oestrus the foetus would be expelled. Accordingly he had found that a single dose of 2 c.c. (500 rat units per c.c.) antuitrin S. injected intravenously into such an animal carrying a mummified foetus did bring about expulsion of the mummy. Of course, one did not use hormone therapy if ovarian manipulation produced the desired effect.

The Reply

Mr. John Hammond, in reply, said that they would excuse him if he had missed one or two points raised by some of his questioners. Perhaps he should deal with the hormone question first, as it had been raised by many speakers. His opinion was that, at the moment, so far as cows were concerned, they did not know quite enough about the effect of hormones to enable him to give them very sound advice for their practical use. In other species of animals they knew quite a lot but, as they realised, from one species to another there were differences. Certainly in the case of heifers in the winter, or in suckling cows, not coming into season, there could be no doubt that injection would rectify matters.

Since he had written that paper, they had been doing a number of hormone injections into cows. He had brought some of the results with him and he could tell them that they had found that 100 milligrammes of horse pituitary would cause a cow to ovulate. One of the troubles he foresaw was not so much the trouble of bringing a cow on heat as that of causing multiple births, for often one obtained twin ovulations. At the present moment he thought that it was safe to advise treating the ovary itself rather than injecting hormones until we knew more about the hormones and they were more standardised. In practice, he had found that squeezing the corpus luteum was very much more effective than the injection of hormones, that is, if the cow had a normal cycle. A cow that was coming on heat regularly, which the majority did, was not a case for hormone treatment so much as for ovarian manipulation. He thought that the trouble with this method of treatment had in the past been that one was inclined to massage the ovary rather than to remove the corpus luteum completely. He had seen many cases where the corpus luteum had only been squeezed without being removed from the ovary; that was perfectly useless. He would very strongly recommend them to use two hands —not one. One hand was put in the vagina to get hold of and pull back the cervix and the other in the rectum to get hold of the ovaries; you could then hold the corpus luteum within your fingers and squeeze the ovary away from it. He disagreed very strongly in those two respects with the film that was shown. So far as one could see at the moment the removal of the corpus luteum was one of the best ways for treating sterility.

The question had been raised about high milk yields causing sterility. The only type of sterility which appeared to be associated with high yields was that of ovarian cysts. These one could treat best by rupturing rather than by hormones. They were investigating the cyst problem at present by hormone injection and they were finding quite a deal of trouble in getting the cysts luteinised; therefore they preferred puncture of the cyst.

In regard to the question about the cow of to-day being abnormal in being forced for high milk production, he would put it to them from the farmer's angle. The farmer would rather get these increased yields and scrap a few cows than reduce his yield and profit by feeding under natural conditions. After all, we were not born with clothes on but we wear them now, and we had to accustom ourselves to seeing the farmer adopt unnatural methods of feeding to achieve high milk production; the farmer would not give up this system.

Under these conditions of high production there was great need to increase our knowledge of the protein, mineral and vitamin requirement of the animal. Every new method adopted to increase milk yield brought to the fore the fact that we knew very little of how the cow worked. The modern cow was just like the motor car; if you did not know the way it worked you had very little chance to put things right if it stopped working. It was not until we got down to the physiology and studied the way it worked that we could deal with the modern cow.

Professor Nicholson had raised the question of the *p*H of the vagina and the question of acidity of the sperm. The reason why high acidity should affect the sperm was that the sperms themselves were not very motile in an acid medium; in fact, if they wanted to keep them outside the body they stored them in a high concentration of CO_2 and then they remained immotile. In washing out with bicarbonate of soda one added something which greatly increased the motility of the sperm; a much better thing to use for this purpose was the new dilutors that were being made for artificial insemination. Formerly it was the alkaline accessory fluids that speeded up the movement of the sperms, and one could achieve the same thing by adding these dilutor fluids.

Mr. Wortley had mentioned the question of examination of the cow ten days after calving. He (the speaker) believed that a lot of the trouble to-day was caused by incomplete cleansing after calving: a temporary condition of infection was set up then which was often unnotjced until many months later when one tried to get the cows in calf. Cases of an enlarged cervix were usually a symptom of increased secretion of oestrin and, in many cases, of small cysts persisting in the ovary.

About the surveys of cow wastage; the statistics of sterility showed, not that about 22 per cent. of the whole number of cows in the country, but 22 per cent. of those that were turned out of herds were sterile. They had made surveys of cow wastage in different parts of the country; each milk recording society in certain districts filled up forms stating for what reason the cows went out of the herd. About 20 per cent. of cows left the herds each year; and of those that left sterility accounted for about 22 per cent. This was done for many thousand cows: they were all dairy herds as distinct from beef herds. Very slight differences occurred in different parts of the country due, perhaps, to the varying methods of keeping cows.

Another speaker raised the point of the clinical changes in the vagina during the different periods of the cycle. It was not possible to diagnose the period of the cycle by taking smears, as it was in the rat. One could, however, be fairly certain if one saw blood on the lips of the vulva, or if one saw a lot of leucocytes on the smear, that heat had occurred

about three days before. That was a natural occurrence; if one found many leucocytes at other times in the cycle one might have suspicions of an infection.

With regard to the two-and-a-half-year-old fat bull which was fertile and the question of sterility in bulls. In New Zealand most of the bulls at two and a half years were quite fertile: it was very often the old bulls from four and a half to five years of age that became sterile through being too fat. The old bull suffered from under-use and over-feeding; the young bull suffered from the reverse, and he thought that was where any differences of opinion about fatness lay.

With fat heifers and animals kept up in show condition, he found it was difficult to get them in calf, but, from experience, he would suggest that by squeezing out the corpus luteum one could make these cows breed. In the wild state, the cow, as soon as she came on heat, was served by the bull but, in a high-milk-yielding herd, she was not so served; they waited and left her to be served at a later heat. Such a sequence of cycles was not natural for the cow and resulted in an ovary overloaded with luteal substance.

By removing the corpus luteum they brought the cow back to the condition she would be in at the first oestrus after calving.

He thought the Chairman hit the point when he said that between the physiological and the pathological there was no hard and fast line that one could draw: the two things merged into one another and when a pathological cause of sterility had been overcome a physiological one might still remain. There was a very close link between the two, especially in those cases of cow sterility which might start as a very minor pathological condition—some mild infection—and ended up by being a physiological case of sterility due to overloading of the ovary with luteal substance.

So far as hormone work went, he thought they required much more enquiry in that field, and they also required a standardisation of the hormones. That work, he believed, was now being carried out by the Medical Research Council, which was trying to get these hormones standardised so that they could know what they were dealing with. When this happened, and when the supplies were cheapened, he thought hormones might serve a very useful purpose in sterility work.

The Chairman, in voicing the indebtedness of the meeting to Dr. Hammond for his paper, said that he thought they should thank Dr. Hammond most sincerely for the sterling work he had put in on the subject of sterility in cattle, and also for the patient way in which he had dealt with them that morning. (Applause.)

It seems remarkable that this line of acari could have survived five approved dippings, and this individual acarus had literally been submerged in sulphur and iodoform for at least 18 hours after the taking of the sample, and yet was very much alive.

It would appear that the only possible inference to be drawn is that so long as any cicatricial material of any kind remains attached to the skin, no matter what the number and potency of the curative agents used, there are beneath those cicatrices all the potentialities of a further outbreak of sheep scab.

CLINICAL COMMUNICATION

The Resistance of the Sheep Scab Acarus to Chemical Agents

P. DENNIS DUNN, M.R.C.V.S.

Veterinary Inspector,
Ministry of Agriculture

The following case may prove of interest to many, whose new duties since the Agriculture Act became law, now include the examination of sheep for the presence of sheep scab acari, either for diagnosis, or post-confirmation examinations of sheep under the Sheep Scab Order.

In the early part of this year disease was confirmed in a flock of sheep numbering 98 ewes and two rams. The disease was well established in the flock, about 20 being affected.

The usual double-dipping was ordered and carried out under police supervision with an approved dip. A few weeks later the owner put the sheep through another single dip. An examination was carried out under the Order after these dippings, but clinical evidence of the existence of scab was still abundant, so a further double dip was accordingly ordered. This was carried out by a professional dipper using an approved arsenical dip.

Soon after the completion of this fifth dipping the owner noticed several sheep had been attacked by the sheep maggot fly and applied a very liberal dressing made up of: Powdered sulphur, iodoform, boric acid and lard.

At the next inspection for clearance, several of the sheep showed large "maggoted" areas, with considerable loss of wool, tissue damage and pus formation. There was little or no evidence of irritation, there being no rubbing or biting whatever. All the maggoted areas were liberally covered with the dressing referred to above.

Before recommending the withdrawal of the restrictions on the sheep, it was decided to take a sample of wool and a skin scraping for microscopic examination. These were taken from around the periphery of a maggoted area, and when obtained consisted of wool, cicatricial matter and a copious admixture of evil-smelling dressing. The whole could best be described as a sticky mass. This material was allowed to dry out as much as possible overnight and the next day the material was scraped lightly with a scalpel over a clean glass slide. Considerable debris was thus deposited on the slide. Microscopic examination of this debris revealed the presence of an extremely active and motile specimen of *Psoroptes communis* (male).

(*Concluded in previous column*)

The Veterinary Record

September 16th, 1939.

Emergency Information for the Profession

IN the news columns of this issue we give such information as we have been able to secure to date regarding matters of special importance to veterinarians at this time and which we deem likely to assist members of the profession in the many duties devolving upon them in consequence of the existence of a state of war. It will be appreciated that, under existing circumstances, information concerning many matters upon which the profession desires immediate enlightenment must inevitably be subject to some unavoidable delay. Official information from the various Government departments has to be submitted to the Public Relations Officer, and we do not propose to speculate by the publication of rumours or hearsay, however reliable any other source may seem to be.

We would assure our readers, however, that the many pressing problems which are common to us all are being actively pursued by the "National" at headquarters. We are in active communication with the various departments and when official information comes to hand it will be published without undue delay.

In connection with the emergency notices from the Ministry of Agriculture, inserted in the same section of this issue, members, in common with stock-owners, will regret the decision to suspend the Licensing of Bulls Order. The benefits of this Order were just becoming visible in the improvement of progeny and we view with apprehension the reintroduction of the scrub bull at a time when the production of good quality cattle is of paramount importance in the defence scheme of the country.

Another notice in the same series refers to the amendment of the Tuberculosis (Attested Herds) Scheme. We are pleased to note that it is the intention of the Minister to maintain those herds already attested or in process of becoming attested, together with the Milk (Special Designations) Order, etc., and the various Diseases of Animals Acts and Orders at present in force.

It will be our persistent endeavour, particularly in view of the specially close contact now being maintained with official sources of information, to furnish our readers with a reliable emergency veterinary news service throughout the period of hostilities.

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Physiological Aspects of Bovine Sterility

IT was inevitable that a paper presented to Congress, N.V.M.A., by an authority so well known as Dr. Hammond, upon a subject of such importance to veterinarians, would stimulate a lively discussion; but it was, we believe, fairly generally recognised that had a discussion taken place upon Dr. Hammond's reply, there would have been no time for any other business that day. We understand that one of the immediate results of this session has been the creation of a clinical section of the Society of Veterinary Practitioners, to discuss and debate veterinary clinical problems, recent papers or publications upon such subjects, so that the points of view of veterinary practitioners may find expression.

It is abundantly clear that it is impossible to have too close co-operation between veterinary clinicians and agricultural research workers engaged upon animal problems.

Our thanks are due to Dr. Hammond for his excellent paper and reply which served to bring home to us this fact.

BUILDING A TUBERCULIN-TESTED HERD

"The perseverance of a dairy farmer in the production of a tuberculin-tested herd was illustrated at a clean milk demonstration on the farm of Mr. Jas. M'Call, Broom Farm, Causewayhead, Stirling, on Monday," states the *Farmers' Weekly* of August 25th.

"Mr. M'Call founded his present herd of 50 tuberculin-tested pedigree Ayrshires in a small way 14 years ago at Blackdub Farm, Bridge of Allan. At the first test of his herd 50 per cent. of his animals reacted.

"Encouraged by Major J. Gilray MacGregor, now one of the Ministry of Agriculture's superintending inspectors, who was then chief veterinary inspector for the county of Stirling, Mr. M'Call persevered with pronounced success. The byre at Broom Farm is recognised as a model.

"Mr. C. H. Chalmers, Chief Milk Inspector of the Department of Health for Scotland, commented on the advanced methods of milk production on view at Broom Farm. 'The progressive increase recorded in milk consumption was throwing an increased responsibility on the farmer and on the dairy industry,' he said. 'Many farmers in Scotland to-day realised this and were making every endeavour to produce milk of the highest quality possible. Scotland's progress in this direction was greater than that achieved in England. But we are not satisfied. What we want to see in Scotland is 100 per cent. of the milk reaching the standard grade, and there is no reason whatever why this should not be so,' stated Mr. Chalmers."

ABSTRACTS

[The Eradication of Tuberculosis from a Commercial Dairy Herd. Kelland, Sir J., Frood, J. L., and Doyle, T. M. (1938.) *Vet. J.* **94.** 93-109. 3 tables. 6 references.]

In this article is recorded the method adopted to eradicate tuberculosis from a large dairy herd where the owner had tried unsuccessfully for 17 years. Conditions for the work were ideal on the estate; additions to the herd were satisfactorily controlled. Before the writers took over the work tests had been done at six-monthly intervals. In the early years the subcutaneous test was used; later the intradermal test was substituted using broth tuberculin.

At the commencement of their work in 1934 the writers decided to apply the intradermal test at 60-day intervals and to use synthetic tuberculin. Reactors would be removed immediately while doubtful reactors would be isolated until retested. In the early stages the test was applied to neck, caudal fold and vulva. The use of the latter site was discontinued, as from results of the test and subsequent *post-mortem* examination findings, the vulva appeared to be less sensitive. A combination of neck and caudal fold testing is recommended though in most cases a single injection in the neck was sufficient to reveal positive reactors.

Tables giving complete information of tests carried out from 1917 to 1937 and showing actual readings in the case of reactors are inserted. A total of 47 reactors were removed from the herd between August, 1934 and July, 1936. Eight reactors were purchased and subjected to *post-mortem* examination and in seven of these tuberculosis (bovine type) was confirmed by biological test. Of seven animals which gave anomalous results to the tuberculin tests and were subjected to *post-mortem* examination, one was affected with "skin tuberculosis," one was proved by biological test to have avian type infection, and five revealed no evidence of disease either macroscopically or by biological test. The writers suggest that some of the reacting animals suffered from either "skin tuberculosis" or avian type infection and in all probability would not react a second time to mammalian tuberculin, and are of opinion, from the results of tuberculin tests carried out on fowls at the owner's cattle-rearing farm, that the calves were infected on the latter premises before removal to the dairy herd. Avian tuberculosis in cattle may be more common than is supposed on general farms in Great Britain.

Although testing at six-monthly intervals may give protection to milk consumers, tuberculin tests at 60-day intervals are advocated for quick and efficient eradication. When a potent tuberculin is used the intradermal test gives accurate and satisfactory results. As a result of the tests this herd contained no reactors after two years and became "attested" under the Ministry of Agriculture's scheme.

J. R.

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[The Effect of the Time of Calving on, and the Relation of the Dry Period to, the Total Lactation Yield. Rigor, T. V. (1938.) *Philipp. J. Anim. Indust.* **5.** 397-404. 3 tables. (7 refs.).]

A study of the milk records of the Alabang herd for 1932 to 1935 shows that cows calving during the dry season produce more milk than those which calve during the wet season. Those calving during the latter period have the strain of lactating throughout the dry season when the pastures are greatly affected by the adverse weather conditions.

The length of time a cow is dry between lactations has a marked effect on production, the yield of milk increasing with the length of the period dry. Such a relationship is relevant, however, only to periods between 40 and 100 days.

D. D. O.

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[The Effect of Sex Hormones on the Renal Excretion of Electrolytes. Thorn, G. W., and Engel, L. L. *J. Exp. Med.* (*Rockefeller Institute.* **68.** 299-312. 7 tables. 2 charts. (9 refs.).]

The effect of injections of various sex hormones on the renal excretion of electrolytes in both normal and suprarenalectomised dogs was studied.

Dogs were maintained under experimental conditions, injected subcutaneously with the hormone in oil, and catheterised every 24 hours. The total 24-hour urine specimen was then analysed.

In normal subjects progesterone, estrone, α-estradiol, and testosterone propionate caused decreased excretion of sodium and chloride estrone, α-estradiol, and testosterone propionate also caused decreased excretion of total nitrogen and inorganic phosphorus.

The use of suprarenalectomised dogs showed that the effects on excretion were not necessarily mediated through the suprarenal gland.

With the exception of progesterone none of the hormones used prolonged the life of suprarenalectomised dogs.

D. D. O.

[The Susceptibility of the Cat to Carbolic Acid. Remlinger, P., and Bailly, J. (1938.) *Bull. Acad. vét. Fr.* **11.** 484-486.]

This is an interesting account of carbolic acid poisoning in cats arising from the use of phenolised anti-rabies vaccines. Inoculation of 20 to 40 c.c. of vaccine made up with 1 per cent. phenol resulted in toxic symptoms, whilst 10 c.c. amounts were without any adverse effects. Injection of 40 c.c. of 1 per cent. phenol solution likewise produced toxic effects and death.

N. J. S.

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[Preliminary Report on Infectious Avian Encephalomyelitis. Van Roekel, H., Bullis, K. L., and Clarke, M. K. (1938.) *J.A.V.M.A.* **93.** 6. 372-375.]

This disease was first described in 1932 by Jones who later referred to it as "Epidemic tremor." It appears usually when the chicks are from one to two weeks old, but may be seen in one- to two-day-old chicks. The first symptoms noted are dull expression of the eyes followed by ataxia or inco-ordination of the leg muscles. Later the chicks are inclined to rest on their haunches and when disturbed show little control over their movement. Some chicks become unable to cry and some show tremor of the head and neck. The tremor varies in frequency and magnitude. Coma and death may ensue or the chick may become so paralysed that it is unable to feed and dies of starvation. Losses over 50 per cent. have occurred; some birds recover and attain maturity. The disease can be transmitted by intracerebral inoculation of brain suspension prepared from affected chicks; the period of incubation varied from 5 to 40 days. The agent which is filtrable and infectious has increased in virulence during serial passages through chicks. It is present in organs other than the brain and is spread by contact. Fertile eggs inoculated at the beginning of incubation have yielded affected chicks; the inoculation of the eggs greatly lowered the hatchability. There is also some field evidence that the infective agent may be egg-borne and that the breeding stock may serve as the reservoir of infection.

C. McG.

The report of the fiftieth session of the Economic Committee of the League of Nations, Official No. C. 178, M. 107 (published by Messrs. Allen & Unwin, price 6d.) contains the recommendations of the Committee of Experts appointed to consider International Rules concerning the Export and Import of Live Animals.

REPORT

[City of Manchester: Report of the Markets Department, year ending March 31st, 1939.]

The report of the Markets Committee of the City of Manchester for the year ending March 31st, 1939, includes a summary of the duties performed in regard to slaughterhouses, Diseases of Animals Acts and Orders and the Orders of the Ministry of Agriculture and Fisheries.

The veterinary staff of the Manchester Markets Department consists of the Chief Veterinary Officer (Mr. W. K. Johnstone) and three Assistant Veterinary Officers.

The number of animals slaughtered at the City Abattoirs totals 589,128. This constitutes a record and is due to the large increase in the number of sheep and lambs killed, these totalling over half a million, much in excess of any previous year.

The number of carcases of meat exposed for sale in the Meat Market also makes a record and shows a total of 1,317,930 and as in the case of slaughtered animals at the abattoirs mutton and lamb show a considerable increase over previous years.

Particulars are given of the total number of animals slaughtered within the city; about 96 per cent. were killed within the Municipal Abattoirs. There are 19 private slaughterhouses in the city.

A summary of work done by the meat inspection staff shows that 677¼ tons of meat were condemned. It is interesting to note that 753 carcases of beef and 174 carcases of mutton consigned to the Meat Market from other places in Great Britain and Ireland were condemned.

The number of condemnations of carcases or part carcases and organs in respect of tuberculosis was 10,034. Work carried out by the Inspectors of the Department in connection with the Diseases of Animals Acts and Orders of the Ministry of Agriculture and Fisheries is also shown.

Because of the increase in main road accidents in the New Forest, caused by wandering ponies during the black-out, the Commoners Defence Association of the Forest suggests that as many of the ponies as possible should be marked so that they will be more visible to motorists. An official advocated the painting of white stripes on the ponies' hind quarters and in the position of the saddle girth.

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The stable of Mr. W. H. Elliott, Portloe, Cornwall, contains four generations of a family of farm horses—great grandmother, grandmother, mother and daughter. The oldest horse is 30 and the youngest four years of age.

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Sept. 20th.—Applications due for Miss Aleen Cust Veterinary Research Scholarship.

Sept. 25th.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 4 p.m.

Nov. 1st.—All changes of address to be reported to Registrar, R.C.V.S.

Nov. 6th.—Provisional commencing date of Animal Management Examination.

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MEMBERS OF THE PROFESSION AND MILITARY SERVICE

Conference at the War Office

A conference was held at the War Office on September 11th, 1939, at which were present the Director, Army Veterinary Services, with his Assistant Officers; the President of the Royal College of Veterinary Surgeons, Professor G. H. Wooldridge, F.R.C.V.S., M.R.I.A.; the President of the National Veterinary Medical Association, H. W. Steele-Bodger, Esq., M.R.C.V.S.; E. C. Lloyd, Esq., Deputy Chief Veterinary Officer, Ministry of Agriculture, and Dr. Fred Bullock, Secretary of the Royal College of Veterinary Surgeons.

The conference discussed the requirements of the Royal Army Veterinary Corps in this war and the position of Panel "A" and "B" veterinary officials under the Agriculture Act, 1938, in relation to military service. The liability of veterinary students to military service was also discussed.

The conference decided to represent to the War Office and to the Ministry of Labour certain matters the outcome of which we hope to disclose at an early date.

Members of the profession who are at present without any definite liability for military service will serve the national interest best by remaining in their appointments or practice until a further statement is published.

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Important Notice to Members

Members who have been called up for military service and who are anxious concerning the carrying on of their practices should communicate at once with the General Secretary, N.V.M.A., 36, Gordon Square, W.C.1.

Petrol Supplies for Veterinary Surgeons

The N.V.M.A. has received information from the Ministry of Mines to the effect that veterinary surgeons will be high in the list of those who may claim extra supplies of petrol. It is, however, necessary for every veterinarian to make direct application to his divisional petroleum officer for this additional supply. He must secure a form, No. R. (M. S.) 1, and fill in one for each motor vehicle he wishes to use. On the back of this form is a section, which has to be completed, giving details of the uses required. We would suggest that on this form at least three headings should be employed, *viz.*: (1) requirements for general practice; (2) requirements for Government duties under the Ministry of Agriculture, and (3) requirements for A.R.P. services for animals. The estimated details of mileage should be clearly given for the use of the officer concerned. It is important to remember that with each application the registration book for the particular vehicle concerned must be sent to the divisional petroleum officer.

The forms of application should be obtained from the post office or local taxation office from which the books of coupons will be secured. These forms when completed should be sent to the divisional petroleum officer for the area.

The following is a list of the divisional petroleum officers, with their divisions and the areas covered:—

1.—Northern Division.—Captain C. C. Webb, Dean Holme, Clayton Road, Jesmond, Newcastle-on-Tyne (Northumberland, Durham, and N. Riding of Yorkshire).

2.—North-Eastern Division.—Major G. T. Wright, Brunswick Sunday Schools, Wesley Street and Hartley Hill, Leeds (Yorkshire, less N. Riding).

3.—North Midland Division.—Lieut.-Colonel A. M. Cockshott, Mechanics Institute, North Church Street, Nottingham (Counties of Nottingham, Lincoln, Rutland, Northampton, Soke of Peterborough, Leicester, and Derby, less the areas of Borough of Glossop and New Mills and Whaley Bridge Urban District Councils, Borough of Buxton, and Chapel-en-le-Frith Rural District Council).

4.—Eastern Division.—Mr. Grafton Pryor, Douglasbank, Lathom Road, Cambridge. (Counties of Norfolk, Suffolk, Cambridge, Huntingdon, Isle of Ely, Bedford, Herts, and Essex, less that part of the Metropolitan Police Area lying within the two latter counties.)

4a.—Herts and Essex Area.—Mr. J. Lindsay Allen, Congregational Sunday School, New London Road (corner of Friar Place), Chelmsford. (Herts and Essex portion of the Eastern Division.)

5.—London Division.—Mr. F. E. M. Beatley, Broadway Congregational Hall, Brook Green Road, Hammersmith. (London and Middlesex and those parts of Essex, Herts, Surrey, and Kent lying within the Metropolitan Police Area.)

6.—Southern Division.—Mr. H. B. Hermon-Hodge, St. Lawrence's Hall, Abbey Street, Reading. (Counties of Surrey—less that part of the

Metropolitan Police Area lying within that county—Hants—plus the areas of Poole Borough, Wimborne Minster Urban District and Wimborne and Cranborne Rural District—Isle of Wight, Berks, Oxford, and Bucks.)

7.—South-Western Division.—Mr. F. J. Salmon, Central Hall, Red Cross Street (off Old Market Street), Bristol, 8 (counties of Gloucester, Wilts, Dorset—excluding the areas of Poole Borough, Wimborne Minster Urban District and Wimborne and Cranborne Rural District—Somerset, Devon, Cornwall, and Scilly Isles.)

8.—Welsh Division.—Mr. W. Morgan, Dormic Café, Andrews Arcade, Queen Street, Cardiff (counties of Cardigan, Radnor, Brecknock, Monmouth, Glamorgan, Carmarthen, and Pembroke).

8a.—North Wales Area.—Mr. B. A. Warner, Queen's Tower, Caernarvon Castle, Caernarvon (counties of Anglesey, Caernarvon, Merioneth, Montgomery, Denbigh, and Flint).

9.—Midland Division.—Colonel W. E. H. Bradburn, St. Martin's Street, Five Ways, Edgbaston, Birmingham, 15 (counties of Stafford, Warwick, Worcester, Hereford, and Salop).

10.—North-Western Division.—Mr. R. H. Whitehorn, 76, Newton Street, Manchester, 1 (counties of Cumberland, Westmorland, Lancaster, Chester, plus the area of the Borough of Glossop and New Mills and Whaley Bridge Urban District Councils, Borough of Buxton, and Chapel-en-le-Frith Rural District Council).

11.—Scotland Division.—Mr. R. B. Crabb, 15, George Street, Edinburgh (Midlothian, East Lothian, West Lothian, Berwick, Roxburgh, Peebles, Selkirk, Dumfries, Fife, Kinross, Perth, and Clackmannan).

11a.—North Scotland Area.—Mr. J. Mackenzie, 10, Constitution Road, Dundee (counties of Angus (Forfar), Aberdeen, Banff, Kincardine, Moray, Orkney, Shetland, Nairn, Inverness, Ross and Cromarty, Sutherland, and Caithness).

11b.—South-West Scotland Area.—Mr. W. Armour, 49, Queen's Street, Glasgow (counties of Renfrew, Lanark, Argyll, Ayr, Bute, Dumbarton, Stirling, Kirkcudbright, and Wigtown).

12.—South-Eastern Division.—Mr. A. Lyons, Bank House, 1, London Road, Tunbridge Wells (Kent and Sussex, less that part of the Metropolitan Police Area lying within the County of Kent).

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SUPPLY OF BIOLOGICAL PRODUCTS

Members of the profession are requested to notify the N.V.M.A. at 36, Gordon Square, in the event of their experiencing any difficulty in securing supplies of sera, vaccines, or other biological products in common use.

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AID FOR INJURED ANIMALS

The National A.R.P. for Animals Committee, on which the National Veterinary Medical Association and animal welfare societies are represented, working under the Home Office and with headquarters at 36, Gordon Square, W.C.1, have during the past week pressed forward rapidly with their preparations for the provision of assistance to animals in the event of attack from the air, while at the same time, through the Press and the broadcasting service, urging all owners of animals not to arrange for the immediate destruction of dogs and cats, which is entirely unnecessary.

Veterinary surgeons have made splendid response to Colonel Stordy's appeal for their co-operation in the work of N.A.R.P.A.C., and there is now no evacuable area without one or more First-aid Centres in charge of a Regional Organiser, in whose area his fellow veterinarians and representatives of the animal welfare societies are rapidly developing a local emergency scheme. For the moment London has been sub-divided into 22 regions. The organisation developed in other evacuable areas is well advanced and it is clear that a useful A.R.P. service for animals is now ready to assist the public and their animals should air raids occur.

Another important activity, of which our readers are already aware, has been the preparation and issue during the past week of the booklet, "A.R.P. for Animals." Information, necessarily somewhat hastily collected, is included on protective devices, the effects of war gases on animals, A.R.P. on the farm, protection of household pets and the horse in relation to air-raid precautions. This booklet issued at 4d., from 36, Gordon Square, is primarily for the instruction of the public, but its possession is likely to prove valuable to every veterinary surgeon who may be called upon to participate in the treatment of animal casualties or to give advice on the problem of animal protection. Suggestions for the improvement of further issues will be appreciated.

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EMERGENCY EQUIPMENT FOR THE VETERINARIAN

In the booklet previously referred to certain notes on equipment have been included. In addition to the items specified it is as well not to forget that volunteers under the N.A.R.P.A.C. service should provide themselves with a steel helmet, a humane killer, a revolver or rifle, a dog catcher, baskets for cats, rubber anti-gas clothing (including rubber gloves and gum-boots for dealing with animals contaminated with liquid gas), and a supply of bleach paste, eusol or permanganate of potash. Up to the present, owing to the absence of funds from Government sources, N.A.R.P.A.C. has only been able to supply some of its veterinary officers with helmets and pistols.

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THE UNWARRANTED DESTRUCTION OF SMALL ANIMALS

When veterinary surgeons are asked by clients to destroy dogs or cats, the reason usually given is that they "would not like the animal to suffer"; also that such animals are

terrified by loud noises. In endeavouring to dissuade clients from taking this course the arguments one may put forward are: (1) that a dog or cat could not distinguish gun fire from thunder, which the majority experience with no marked manifestation of terror; (2) that if the animal is allowed to remain with its owner it runs no greater risk than the latter—should it be injured, then arises the time to make a decision to part with it or to have it treated; (3) that from the point of view of gas warfare, most homes have a room, prepared against gas, into which the animal can be taken until the "all clear" is given. Alternatively, the owner can make or buy boxes suitable for the prevention of gas contamination; (4) that plenty of safe areas are available to which animals can be evacuated. For the evacuation of the animals of the poor in London, the Duchess of Hamilton, working under N.A.R.P.A.C., has organised a service whereby homes with free board can be secured in safe areas.

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A.R.P. (ANIMALS) LITERATURE

In connection with the general subject of the protection of animals in warfare, readers will be well advised to provide themselves, not only with the recently-issued N.A.R.P.A.C. publication, "A.R.P. for Animals," price 4d., post free, from the N.V.M.A., 36, Gordon Square, but with the following, obtainable from H.M. Stationery Office: Handbook No. 12, "A.R.P. for Animals," price 3d., post free; Handbook No. 3, "Medical Treatment of Gas Casualties," price 8d., post free; Handbook No. 9, "Incendiary Bombs and Fire Precautions," 7d., post free—which contains material of much importance for the protection of the veterinary surgeon's own premises.

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ADVERTISERS' EMERGENCY ADDRESSES

In common with others, many firms using this journal as an advertising medium have moved their offices to emergency locations. Our readers, therefore, are asked to note any such changes of address intimated in the announcements of our advertisers.

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EMERGENCY NOTICES FROM THE MINISTRY OF AGRICULTURE

In view of the emergency situation created by the outbreak of war, the following notices have been issued by the Ministry of Agriculture:—

Suspected Cases of Disease Among Stock.—Every farmer will be aware of his legal obligations as regards reporting immediately to the police suspected cases of disease among his stock.

The prompt reporting of disease ensures the early application of control measures which minimise losses and is, therefore, even more necessary in present circumstances than in ordinary times.

All stock owners are, therefore, urged to exercise the greatest vigilance and to report immediately any suspicious sign that they may observe among their stock. By so doing, they will be helping to conserve the national food supply as well as serving their own interests.

Suspension of Bull-Licensing.—It has been decided that during the war the licensing of bulls in Great Britain will be suspended. Farmers should, therefore, note that for the time being a licence to keep a bull will not be necessary and applications for licences should not be made. Fees paid by farmers in respect of bulls, for which applications for licences have been made but which have not been inspected, will be returned in due course.

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Amendment of the Tuberculosis (Attested Herds) Scheme.—The Minister of Agriculture and Fisheries has amended the Tuberculosis (Attested Herds) Scheme so as to provide that he may, at his discretion, decline to accept and proceed upon any application under the Scheme by the owner of a herd of cattle. The amendment came into operation on September 5th, 1939. For the time being no fresh applications under the Scheme will be accepted. The position of herds which are already attested, or which are undergoing or awaiting official or assisted tests under the Scheme with a view to attestation, will not be affected, and any application under the Scheme made on or before September 4th will be proceeded with.

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Closing of Quarantine Station.—The Ministry of Agriculture and Fisheries announces that, in consequence of the outbreak of war, the London Quarantine Station, East India Dock, London, E.14, will be closed until further notice.

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WAR RISKS PERSONAL ACCIDENT INSURANCE

In view of the fact that all forms of personal accident insurance, including that of the N.V.M.A., exclude war risks, and bearing in mind that veterinary surgeons in the course of their duties must expose themselves to a considerable degree of risk in the event of air raids, we would draw their attention to the A.R.P. Accident Insurance Scheme formulated by the A.R.P. Insurance Association, 3, Bucklersbury, London, E.C.4.

Full particulars of terms and benefits will be forwarded on application.

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PERSONAL

Retirement Presentations to Colonel J. Irvine-Smith.—The esteem in which Johannesburg holds Colonel J. Irvine-Smith, C.B.E., V.D., J.P., M.R.C.V.S., was demonstrated when no fewer than five presentations were made to him on his retirement from the position of Director of Abattoirs and Livestock Markets.

From the City Council he received a testimonial under the official seal signed by the Mayor and the Town Clerk.

Heads of departments met and presented him with a small safe. The natives of his department presented him with an inscribed leather wallet, and the European staff gave him a handsome desk with fitted steel drawers.

The fifth ceremony took place in the Carlton Hotel, when the Witwatersrand and Pretoria Wholesale Butchers' Association were the hosts.

The staff presentation was made in the offices of the abattoirs by Dr. G. Martinaglia, the new assistant director.

At the wholesale butchers' ceremony in the Carlton Hotel, Mr. M. Sproel, the chairman, in making a gift of an onyx inkstand, paid a high tribute to the retiring director, and said that the butchers did not want the abattoirs to be moved from Newtown.

Mr. Lionel Leveson, chairman of the Public Health Committee, and Mr. D. Penry Roberts also paid tribute to Colonel Irvine-Smith.

Mr. Michael H. Kam, secretary of the association, extended a welcome to the new director, Mr. A. C. Kirkpatrick, M.R.C.V.S., saying that he was very well known to the industry as assistant, and had well earned his promotion.

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Births.—Ottaway.—On September 7th, 1939, at Dunmow, Essex, to Grace, wife of C. W. Ottaway, M.R.C.V.S., a son.

Pasfield.—On September 5th, to Mrs. M. A. F. Pasfield (*née* Patten), Courtlands Farm, Coolham, Horsham, Sussex, a daughter, Jennifer. Both doing well.

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Marriage.—Downe—Billson.—On September 5th, 1939, at Christ Church, Sutton, Claud H. Downe, M.R.C.V.S., of Diss, Norfolk, to Eileen Margery Billson, of Sutton, Surrey.

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Will: Sir Frederick Hobday's Estate

Sir Frederick Thomas George Hobday, K.C.M.G., F.R.C.V.S., F.R.S.E., of Kensington, W., Hon. Veterinary Surgeon to the King, Past Principal and Dean, Emeritus Professor of Surgery, the Royal Veterinary College, London, who died on June 24th, aged 69, left estate of the gross value of £11,676, with net personalty £11,072. He left:—

His professional and surgical instruments to the students' libraries and surgical departments of the various veterinary training colleges in Great Britain and Northern Ireland, the London College in Camden Town to have the first selection; his insignia, war decorations, honours, certificates, Court uniform, as Honorary Veterinary Surgeon to the King, and his College medals to the Students' Union Society of the Royal Veterinary College, London, and also £10 for a suitable case in which they can be displayed; £100 to the Royal College of Veterinary Surgeons, to pay as a student's prize—open to all veterinary training colleges in Great Britain and Northern Ireland—the travelling fare of a third-year student to visit either a French, German, Dutch, Danish, or Italian veterinary school; £50 each to his "dear godchildren"—Rodger Taylor, "the first little veterinary thoroughbred born into the veterinary world," son of Mr. Taylor and Mrs. Gertrude Taylor, the first lady to take the degree of Bachelor of Veterinary Science of Liverpool University; and Hamish McCunn and David Miles; also, apart from other bequests, the residue of the property to his wife for life with remainder to his son, Frederick Thomas John Hobday.

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R.C.V.S. OBITUARY

Channon, John Stone, 96, Stanford Avenue, Brighton, Capt. R.A.V.C. (T.A. Res.). Graduated London, December 22nd, 1887. Died September 3rd, 1939, aged 73 years.

Conisbee, Alfred, Yenda, Childs Hall Road, Great Bookham, Leatherhead, Surrey, Capt. late R.A.V.C. Graduated New Edinburgh, April 24th, 1884. Died September 6th, 1939; aged 80 years.

Mr. Arnold Eccles, M.R.C.V.S.

It was with deep regret that we had to record, in our issue of last week, the sudden death at Guildford, on August 30th, 1939, of Mr. Arnold Eccles, M.R.C.V.S. Mr. Eccles was the youngest son of Mrs. Eccles, 4, Woodcroft Avenue, Broomhill, Glasgow, and the late Samuel Eccles.

Mr. Eccles qualified in December, 1923, and immediately joined the big foot-and-mouth disease campaign of the Ministry of Agriculture and Fisheries. Later he entered the permanent staff of the Ministry and was stationed for the most part in East Anglia. About ten years ago, he was transferred to the Ministry's Laboratory at Weybridge, and thereafter joined the staff of the Foot-and-Mouth Disease Committee. During this period he has been engaged in investigating foot-and-mouth disease at the Experimental Station, Pirbright, and recently read a paper before a Congress on that subject in Paris.

Always of a bright and optimistic disposition, he was able to take all obstacles in his stride and to make many friends.

For some time, he had been in indifferent health, but little was it expected that such a useful life should be cut off in its prime.

The funeral service took place in Glasgow on Monday, September 4th, and was followed by the interment at Irvine Cemetery, Ayrshire. Owing to the war, the only representatives of the veterinary profession present were Major J. G. McGregor and Captain W. Watt, but floral tributes were sent from: Colleagues of the Ministry's Veterinary Laboratory and the Imperial Bureau of Animal Health, Weybridge; colleagues and the staff of the Foot-and-Mouth Research Station, Pirbright; Captain T. Bannatyne, M.R.C.V.S., D.V.S.M.; Mr. N. Dobson, B.Sc., M.R.C.V.S., and Mr. A. M. Graham, M.R.C.V.S.

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ZOOLOGICAL GARDENS PRECAUTIONS

"When the Zoo reopens the visitor will find everything superficially the same as before with the exception of the reptile house and aquarium, which will be closed," writes the *Times* Zoo special correspondent. "The Zoo's magnificent collection of poisonous snakes has been destroyed. Several constrictor snakes and a number of others which were neither tame nor

extremely valuable have also gone the way of their poisonous relatives. The big pythons, however, have been saved and are at the moment in enormous, strong wooden boxes in the centre space of the house.

"The fish from the aquarium have not all been disposed of, and though the show tanks have been emptied and their glass covered with strips of paper to prevent splinters flying many of the freshwater fish have been released in the Three Island pond, and others, notably eels, have found a home in the supply tanks which have been kept filled.

"All the elephants have been removed to Whipsnade. To make room for them it was necessary to be drastic in only one instance. The young African bull elephant which was about two-thirds grown had to be destroyed. It was considered that in any event his accommodation at Whipsnade would be insufficient to keep him in if he grew to adult size. The giant pandas have all gone to Whipsnade, and probably one or two other animals of great financial or sentimental value, such as Bill, the tame puma, may follow, but at the moment no more animals are being moved.

"Naturally, with a long period in which the gardens are closed to the public, the Zoo's strength will have to be cut down on the score of food. Fish-eaters will present a special problem. Some of the sea-lions, pelicans, and penguins will have to learn to eat meat smeared with cod liver oil or go. The Society will probably reduce its stock of lions, since 14 lb. of meat a day will present the Zoo, and incidentally the country, with a rather heavy bill, but so far as is reasonably possible the Zoo hopes for business as usual."

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INTERNATIONAL CONGRESS OF GENETICS

(*Continued from page* 1135)

At both the sittings of the section dealing with livestock improvement, Sir Arthur Olver, Principal of the Royal (Dick) Veterinary College, Edinburgh, presided.

Artificial Insemination

The forenoon session in the section devoted to the discussion of livestock subjects was from a purely technical point of view very interesting. It was occupied with the submission of papers and subsequent discussion on the mating of farm stock by artificial insemination. The discussion was illustrated by a film exhibition by Dr. T. M. Olbrycht, a Polish geneticist, showing what is known as the Livow method of artificial insemination.

In a paper by Dr. T. Bonadonna, Italy, and read in his absence by Dr. J. E. Nichols, Edinburgh, it was pointed out that nearly 100 local centres for artificial insemination were now working in Italy and Italian Colonies, about 80 per cent. of their activities being with cattle. Artificial insemination was used chiefly to overcome sterility and any shortage of suitable males in some areas. In 1938 and 1939 about 20,000 females had been inseminated artificially. In cattle, pregnancy had been obtained in 60 to 80 per cent. of cases with single inseminations, and up to 90 per cent. from one, two, or three inseminations; in sheep 80 to 90 per cent. even with diluted semen; in mares 70 to 80 per cent. when more than one insemination had been possible in one heat period; in sows about 90 per cent. with whole or diluted semen; and in hens it was possible to get 90 to 100 per cent. fertile eggs when the semen was injected into the oviduct.

The Farming News reports that an American contribution to the discussion, read by Dr. M'Phee, related experiences in three sheep-breeding seasons in Idaho, U.S.A., during which ewes were inseminated with semen shipped by an air express over a distance of 700 miles. The results of lambing given in this account were not very impressive. Inseminations were made at from 22 to 200 hours after collection of semen. The longest interval from collection to insemination from which a pregnancy resulted was 115 hours.

In a paper contributed by Mr. N. Teodoreanu, Bukharest, describing experiments in Rumania, read in the absence of the author by Dr. A. D. Buchanan Smith, Edinburgh, it was stated that injection of undiluted sperm immediately after collection (one to two minutes) to 82 ewes on heat resulted in 96·47 per cent. of fertility, a figure which was equal to that obtained with normal mating and higher than that recorded by other authors. The length of gestation in ewes which had been inseminated artificially was the same as in those which had mated normally. The results of all experiments on artificial insemination indicated that the percentage of fertilisation was higher if undiluted sperm was used.

Sheep and Cattle in Kenya

In a paper dealing with results achieved in Kenya, Mr. J. Anderson, M.R.C.V.S., Naivasha, explained that the practical application of artificial insemination to both cattle and sheep on European-owned farms in Kenya (where experiments have been conducted since 1935) is carried out by the farmers themselves, who receive instruction in the technique at the Experimental Station, Naivasha. About 12,000 cows are now being inseminated per year in Kenya with satisfactory results, and with sheep results very nearly comparable with those from ordinary service have been obtained.

The results from artificial insemination of ewes, it was further pointed out by Mr. Anderson, were better when the insemination was performed at a time of the year favourable to the reproductive processes in the ewe. The somewhat poorer results obtained from some experiments were probably to a large extent due to the inseminations having been performed at an unsuitable time of the year. It was considered that the main problem in artificial insemination of cattle was the determination of the fertility of the bull from sperm examination.

Need of Standard Test

It was emphasised in a joint paper by Mr. Joseph Edwards and Dr. Arthur Walton, Cambridge, that since the contribution which the technique of artificial insemination had to make to livestock improvement lay in the greater use that can be made of sires of known genetic merit, factors controlling the fertility of such sires (the rate of production and the quality of their semen) were of great importance. The usefulness of a prepotent sire was determined by his ability to maintain a high rate of sperm production and to produce spermatozoa of a quality that would survive storage and transport.

The need of a standard test for the rate of sperm production and a test that would relate

the vitality of the spermatozoa to their fertilising capacity in a herd of normal females was also stressed. Both were essential, the authors said, for the successful practice of artificial insemination, as standards for experimental work on factors governing sperm production, and for the proper exploitation of sires of superior genetic constitution.

The chairman at the close of the discussion said the subject was of great practical as well as scientific importance. To him as an outsider these new methods appeared to raise as many difficulties as they solved. There was the difficulty in fertility tests of apportioning blame for failure on the male or female side. Some elaborate control was needed for these tests. Another difficulty was the maintenance of viability. He thought the experiments on respiration were among the most promising lines. But there was a great deal of physical and chemical work to be done in securing better dilutions.

Cattle in Semi-Arid Regions

Dr. J. H. R. Bisschop, Pretoria, South Africa, read a paper on "Bionomic Studies on Indigenous and Exogenous Cattle in the Semi-Arid Regions of the Union of South Africa." Introducing his subject, Dr. Bisschop suggested that if animal breeding was to derive the benefit it should from bionomic researches it was essential that workers in this field of research throughout the world should supply each other with full information concerning the methods employed by them to collect reliable experimental data, and if at all possible such workers should adopt sufficiently similar experimental methods to make their work comparable.

Since 1925, he explained, investigations had been in progress at a veterinary research station in South Africa concerning the relation between environment and animal function. The results up to date showed that the Afrikander (indigenous) grades had maintained themselves phenotypically for three generations. The higher grades of the exogenous breeds (Friesians, Red Polls and Sussex) had failed to do so, and were exhibiting conformational deterioration.

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Erratum.—In Mr. F. T. Day's reply to the discussion of his Congress paper, "Sterility in the Mare associated with Irregularities of the Oestrous Cycle," published in our last issue, in the third paragraph (page 1124, column 2), line 8, *for* "bad foal getters" *read* "good foal getters."

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THERAPEUTIC VALUE OF ARTIFICIALLY INDUCED FEVER

In support of the view so strongly emphasised in his heading "Fever—the miracle-worker," Mr. J. J. Dunning, in *Physical Culture*, cites the following: "A startling and gratifying episode in heat's history occurred at an osteopathic college in America. The physiologist kept a score or two of dogs in cages in a small room adjacent the college's central heating department. The dogs being given test meals of milk were healthy and fat, but suddenly distemper broke out; every dog was stricken and there appeared to be no hope for them.

"It is odd how often chance and accident lead to discoveries in healing. Somehow without intention, and contrary to the usual procedure, the full pressure of steam was passed through pipes in the dog house—a pressure sufficient to heat very large buildings during a mid-Western winter. The physiologist, returning after 24 hours, opened the door and was fairly bowled over by the compressed heat. He thought the building afire and that the dogs must be dead. But the result of the accident was quite otherwise. Yesterday's moribund dogs showed some signs of life. A few others were panting contentedly, not particularly comfortable perhaps, but showing no sign of unhappiness. Many drank copiously of water. What's good for 24 hours, the physiologist thought, might be good for 24 hours more. The second day improvement was everywhere. Yesterday's panting dogs were hopping about excitedly asking to get out, get a drink and explore. The half-dead dogs lapped water, tested shaky legs, and sat down for another dose. After the third day all dogs were cured, establishing a most remarkable collection of case histories."

Correspondence

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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THE BASIS OF LEADERSHIP

To the Editor of the Veterinary Record

Sir,—Picking up the *Veterinary Record* of September 2nd just now for further information *re* A.R.P. for animals, I found myself reading first the last article headed "Basis of Leadership." I feel I should like to thank the Reviewer for this contribution, and express the hope that others will find time not only to read the paragraph in question, but also the book referred to.

I think at such a time one has need to be reminded of the things that matter most, and again, would like to thank the Reviewer.

Yours truly,
Hilda Bisset.

Bray.
September 6th, 1939.

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SIR FREDERICK HOBDAY: "IN MEMORIAM"

To the Editor of the Veterinary Record

Sir,—Magnanimous as he ever was throughout his whole professional life, Fred Hobday by his last will and testament has emphasised that magnanimity.

A great soul has answered the call to "The Higher Command," and I think the least we who are left can do to carry on his great work is to sustain his memory in some practical form. Scholarships were very dear to him. Why not a "Hobday Scholarship"? With this end in view and to help to bring this idea to fruition, I would gladly subscribe my monetary portion.

Yours faithfully,
W. M. Scott.

Fryern Hall,
Bridgwater,
Somerset.
September 11th, 1939.